Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE TREASURY DEPARTMENT STANDARD FOR DRINKING WATER; ITS VALUE AND ENFORCEMENT[1]

By H. P. Letton

Shortly after the promulgation of the Interstate Quarantine Regulations requiring interstate common carriers to furnish pure drinking water for passengers, it became necessary to establish a standard as a basis upon which to formulate an opinion as to the safety of any given water. The Secretary of the Treasury in January, 1913, appointed a committee of fifteen eminent bacteriologists and sanitarians to recommend such a standard. After somewhat over a year's study the committee made recommendations which were adopted by the Secretary and promulgated as part of the Quarantine Regulations on October 31, 1914. The committee was very explicit in pointing out that the recommended standard was not a "standard of purity," but was, on the contrary, a "standard of permissible impurities." Briefly, the standard requires that there shall be not more than 100 colonies per cubic centimeter which develop on agar incubated 24 hours at 37°C., and that there shall not be more than 2 B. coli per 100 cubic centimeters when the water is tested in accordance with the recommended procedure.

This was the first attempt made in this country to establish a general standard for the bacterial content of drinking water, although such standards have been in use in other countries for many years. Because of our peculiar governmental system, each state has been a law unto itself, and a water which would be considered of satisfactory quality in one state might fail to pass the requirements of an adjoining one. There is absolutely no question but that the establishment of the Treasury Department standard has been an impelling force in improving the quality of public water supplies throughout the country. As far as the author knows, there is only one state, Minnesota, which before the promulgation of this standard required that a public water supply should be free from B. coli in as large a quantity as 50 cubic centimeters. Minnesota has required for some time that B. coli be absent in 100 cubic centimeters.

---

[1] Read before the Richmond Convention, May 9, 1917.

The fact that the federal government requires railroads and other carriers to furnish passengers with a purer water than that required by most state boards of health has stimulated many localities to better the quality of their water supplies until they conform to the standard under discussion. It is now a common experience when visiting a city where periodic analyses are made of water from the public supply, to find the tests being performed strictly in accordance with the technic recommended by the commission, and it is pertinent to note that such cities take pride in stating that their water conforms to the Treasury Department standard.

The commission formulating the standard had in mind that it was to be applied primarily to water taken directly from cars or vessels. Realizing that in such cases the water might have been stored for some time and that such storage would undoubtedly cause marked changes in the bacterial flora, they set the maximum permissible number of bacteria which would develop on agar at 37°C. at 100 per cubic centimeter. The commission stated that they would have considerably reduced this number if the standard was to be applied to water at its source.

As regards bacteria of the bacillus coli group, however, they considered that inasmuch as these bacteria do not multiply in water, but, on the other hand, die out rather rapidly, the permissible number could be set within very definite limits. It has been this part of the standard, which requires that there shall be not more than 2 B. coli per 100 cubic centimeters, that has received the most criticism. It is not believed, however, that this criticism has been well taken for reasons which will be enumerated.

While the standard under discussion applies to lake and river carriers, as well as railroads, it is in the latter connection that it has a direct bearing on public water supplies since, in the majority of cases, these carriers obtain their drinking water from such sources. The question of drinking water on lake vessels has been previously discussed before this Association and will not be dwelt upon at this time.

In order to ascertain whether it was feasible to utilize this standard in the manner presupposed by the commission, several hundred samples were collected from railroad cars within the Sanitary District of the Great Lakes. At the time the samples were collected information was gathered regarding the point or points where the water was originally obtained, as well as the length of time that had elapsed since the coolers were filled. In few cases could information of any reliability be obtained. The analyses of the water also gave little of value, inasmuch as certain samples, supposedly from the same source of supply, taken on different days, gave widely divergent results. Moreover, in case a sample failed to meet the requirements of the standard, there was no way of knowing whether the impurities were present in the source of supply or were introduced in the process of filling the coolers. As a result of these analyses it was plainly evident that, in order to bring about any permanent and beneficial results from the enforcement of the standard, reliable and accurate data regarding the source of supply must be obtained.

Inasmuch as this would require a sanitary survey of each source, and since analyses of shipped samples are not as reliable as those examined immediately after collection, it was deemed advisable to carry a laboratory into the field. A portable laboratory was therefore devised and used for about two months. The results of the field work indicated that it was the proper method of handling the situation, but because of certain difficulties with the portable laboratory, its use was discontinued and a laboratory car designed. This car, which was built by the Pullman Company, has now been on the road for about two months, and has demonstrated its usefulness in handling the problem.

After having made some thirty sanitary surveys of water supplies used by railroads, it became more and more evident that such surveys were absolutely necessary to correlate the analyses, in order than an opinion could be formed as to the safety of any given water. In order to make the surveys mandatory the Interstate Quarantine Regulations were amended on February 12, 1917, so that they now require that the water shall not only conform to the bacteriological standard, but shall not be from a supply that is exposed to contamination.

Formerly, if a sample of water taken from a source which was obviously contaminated, happened to contain not more than 2 B. coli per 100 cubic centimeters, the source of supply would have been approved. Under the present regulations, however, no matter what the bacteriological analysis indicates, the use of water from such a supply would not be permitted.

The matter of enforcing these regulations in the Sanitary District of the Great Lakes has been from the start carried on with the idea of not only benefiting directly the passengers on railroad trains but benefiting, indirectly, the much greater number of people using the same supplies in towns. When the sanitary survey and analysis show that a supply is contaminated or is exposed to contamination, a letter is prepared to the municipality or private water company, as the case may be, in which the conditions are outlined and suggestions made for betterments. In many cases these recommendations have been adopted, usually because the municipalities are aware that unless corrective measures are adopted, the railroads will not be permitted to use the supply.

To return to the question of the B. coli requirements of the standard; over one hundred investigations have been made of water supplies used by railroads in Illinois and Michigan. These supplies have been of all types, shallow wells, deep wells, and surface water, treated and untreated. The filtration plants, ranging in size from 15,000,000 gallons per day to 1,000,000 gallons per day, all produced a water well within the bacteriological requirements. All the disinfection plants, most of which used liquid chlorine, produced a satisfactory water. The only supplies failing to meet the standard were untreated supplies and a few ground water supplies. In everyone of the latter cases, however, the sanitary survey had shown some point of possible contamination. Only two supplies failed to meet the total count requirement, and in each of these instances the water had been stored in large reservoirs which had not been cleaned for a considerable period. The agar count, as a general rule, was less than 10 per cubic centimeter. The fact that most of these analyses were made during the winter months undoubtedly had some influence on the low counts. These data are sufficient to convince the author that it is possible for any public water supply to meet the requirements of the Treasury Department standard without undue expense.

Several investigators have recently brought out data affecting the significance of the B. coli test by differentiating the organisms into fecal and non-fecal strains. Their observations, however, have not yet been generally accepted, and until they are and the technique is standardized, the presence of any of the B. coli group in a water must be considered as evidence of contamination. If sufficiently intensive investigations are made of water supplies containing B. coli, in practically every instance a possible entrance for the organisms will be discovered.

From the foregoing statements the following conclusions can be derived:

1. The requirement of the standard regarding total count is very lenient. It could be reduced more than half without eliminating any but an extremely small percentage of supplies that would otherwise pass the requirements.
2. The limit of permissible B. coli content is not too low. A properly operated filtration plant will produce a better water than the standard requires. A disinfection plant which will not produce a water within the limits should be considered as only a temporary protection and filtration should be adopted. An untreated ground supply containing more B. coli than the standard permits is being contaminated by outside sources which should be discovered and eliminated.
3. Sanitary surveys of the sources of supply are absolutely essential to correlate the bacteriological analyses.
4. The Treasury Department standard has been of immeasurable value, not only by causing carriers to furnish a safe drinking water for passengers, but more so by the establishment of a high criterion for judging the quality of public water supplies throughout the United States.

DISCUSSION

Robert Spurr Weston: The speaker is not entirely in accord with all provisions of this excellent paper, particularly those regarding the establishment of a standard for waters based entirely upon bacteriological tests. While a step in the right direction, it should be taken more or less tentatively.

The speaker has had a number of cases in his practice where ground waters which were from an undeniably unpolluted source have been drawn from strata where partially fossilized vegetable matter affected the water enough to give some of the positive B. coli tests. Many organisms that will respond to presumptive B. coli tests are not of sewage origin and should not be called B. coli; and water containing such organisms should not be condemned. That is, the presence of such organisms in a water should not necessarily be an indication of bad quality. The Treasury Department ought to give a good deal more consideration to this fact than it seems to have done heretofore, and not be too rigid in its classification of bacteria.

JOHN W. ALVORD: The introduction of a purity standard for water will undoubtedly have in general beneficial effects; everything will depend upon the good judgment with which these standards are enforced. Some water supplies undoubtedly will be done an injustice; other localities that are careless and indifferent about their water supplies will undoubtedly have to think seriously about improving them.

To illustrate the difficulty of this matter, the speaker would give an illustration. There are two large adjacent cities that take their water supply from the same source. One of them has had a great deal of typhoid recently, because the officials have been indifferent and to some extent careless about maintaining a high standard of purity for the water. However, because of the presence of typhoid, the Treasury Department refused to allow common carriers to take water from the public supply of that particular city. Not far away there is another large city which takes its water supply from the same source. B. coli have been found in half of the ordinary samples taken from the latter city, although its typhoid rate is remarkably low considering the amount of B. coli present in the samples from its supply. The Treasury Department has not demanded that the water from the latter city should be excluded from use by common carriers; so it is evident that there is some discretion being exercised even in view of the apparent rigidity of the standards. Undoubtedly this is a wise way of acting on the problem. But the public, not understanding the importance of surrounding conditions, cannot see why an absolute measure for purity is impracticable.

F. W. CAPPELEN: At one of Minneapolis' department stores, located in the Dayton Building, there was a large fire on February 17, 1917. About a block away is the Glass-Block store, which is the city's largest department store. After the fire had taken place in the Dayton store it was observed that the artesian well water supply in the Glass-Block store tasted smoky. The state board of health was notified at once, and upon investigation it found that the Glass-Block artesian well supply was polluted. The fact that the water there tasted of smoke was sufficient proof that there was some connection between that supply and the artesian well supply of the Dayton store where the fire had occurred. The Glass-Block store has some 1500 employees, all of whom are using this water, which supply was supposed to come from sandrock formation 700 feet below the surface, without contamination and absolutely pure. Upon finding that it was polluted the supply was ordered cut off, and this order was complied with by the owner at once. The geological formation at Minneapolis is about 30 feet of glacial drift nearest the surface, then from 20 to 30 feet of limestone rock, and under this the so-called St. Peter sandstone, which is 800 feet and upwards in depth, and in this latter lies the artesian well water basin from which all of the artesian well supplies in Minneapolis are drawn. Generally a 12-inch casing is driven through the lime rock, and then a smaller casing is driven inside that into the sandrock for a certain distance. There is no seal between the two casings at all, so that any polluted water that may pass through the fissures in the lime rock will follow down around the upper casing and come up between the two casings and pollute the supply. That happened in the case of the Dayton supply and also at the Radisson Hotel, and the Glass-Block store; the Radisson Hotel being the largest hotel in Minneapolis. It is possible that the same trouble exists elsewhere in the city, as for instance in the West Hotel, where this Assocaition had its convention headquarters when it last met in Minneapolis, but this has not yet been investigated. All these places have the city supply cross-connected, and the city officials cannot tell when they will get some of the bad water from the well systems into their system when the property owners cross-connect them without the city's knowledge. So the city has ordered all such connections cut off absolutely, and will insist upon this being done wherever evidence is found that warrants such action.

Edward Bartow: The author has mentioned some general instances where improvements have been made since the Treasury Department regulations were published. It might be interesting to note a specific case. In one of the Illinois water supplies the count as found by the author was less than 10; but B. coli were found to be present in quantities greater than 2 per 50 cubic centimeters. Investigation showed that there was seepage into the clear water well. The works included an iron removal plant. The water was good at the well, but after iron removal and filtration was found to be slightly contaminated. The seepage was unknown to the superintendent, but the investigation of the Treasury Department caused him to make a very careful examination, as the result of which the trouble was corrected.

When the Treasury standards were first established many sanitary specialists thought they were too severe; but it seems that with modern methods of filtration and sterilization, it will be entirely possible to have the water supplied throughout the country conform to these standards.

Lewis I. Birdsall: A filtered water that is practically sterile and entirely free from B. coli when it leaves the purification plant may fail to meet the requirements of the Treasury Department at the point of delivery to interstate carriers. Systematic flushing of the distribution lines for a period of several years may be required in order to entirely remove from the pipes the organic and inorganic material that has accumulated in them during the many years that unpurified water was pumped directly into the mains previous to the construction of the purification plant. Sterilization of the pipes is not possible until this material has been removed. Therefore until the pipe lines are clean it is impossible to deliver to the interstate carriers a water that will meet the Treasury Department's standards, regardless of the purity of the filter plant effluent.

Mayo Tolman: Mr. Alvord spoke of using discretion in issuing certificates of purity. The speaker has found that it is essential to use a great deal of discretion in West Virginia for otherwise many railroad water supplies that are in reality of excellent purity would be condemned. The state hygienic laboratory is at Morgantown, which is located on a branch railroad in practically the extreme northern portion of the state. The result is that it usually takes from thirty-six to forty-two hours for samples collected in the southern portion of the state to reach the laboratory. While these samples may not show the presence of B. coli, the bacterial content commonly varies between 400 and 800, which is above the Treasury limit. In order to aid the railroads the speaker caused a number of samples to be analyzed at hospital laboratories in the southern end of the state, sending check samples collected at the same time to the state hygienic laboratory at Morgantown. A comparison of the series of results thus obtained gave a fair idea of the increase that might be expected in the bacterial content due to the lapse of time during shipment. By deducting this probable increase from the analyses made at the state laboratory the speaker believes that a figure is obtained which comes much nearer representing the actual condition of the water as furnished by the railroad.

There is one aspect of the problem of railroad water supplies that has not been touched upon and yet, in the speaker's opinion, it is of great importance. It has frequently been his observation that the water as it comes to the railroad property may be of high purity but the methods of handling are such that it may be seriously polluted before it reaches the water coolers. For example, at several stations of which he has knowledge, the water is supplied to the coolers through a short length of hose that, when not in use, is allowed to lie between the rails and the station platform, where hundreds of men expectorate. Again the water may become polluted after it enters the cooler. The speaker once saw a water cooler swabbed out with a piece of waste that previously had been used as a towel by a couple of engine wipers. If possible some form of control should be exercised over the methods of handling railroad drinking waters.

CHESTER G. WIGLEY: The State Department of Health of New Jersey has taken over the work of examining water supplies of railroads, and some experiences it has had in the past several years in this work may be of interest. It was found after collecting several samples that it was absolutely necessary to collect samples of water from the source in order to get a measure of the quality of the water at its origin. That emphasizes the point brought out by Mr. Tolman. Shipping the samples to the laboratory has resulted in higher bacteriological counts at 37°C., and it was found that the B. coli did not increase in the same manner. There is an objection to collecting samples at the source of supply because it eliminates a great many possibilities of pollution before the supply can be used upon the train. Possibly the standards of the Federal Health Service might take into consideration the place where the water is used. Certainly it is not altogether proper that the water should be certified for use of interstate carriers solely on the quality of the supply at the source. It is often affected in some way or other before it is used on the train. There are regulations controlling the method of filling tanks and the icing of supplies, such as a requirement that the men icing tanks must wear rubber gloves; an examination of the water supplies used on the trains will show quite a different bacterial content from the samples collected at the source of supply.

Sanitary inspection of a water supply is usually made by some assistant at the laboratory, whose function it is to examine the water, and in the last analysis the sanitary inspection can only be that man's best judgment of the conditions. It is concluded in many cases that the bacterial count alone is not an absolute measure of safety of the particular water examined. The science of bacteriology has not at the present time reached the high plane by means of which, after examining a water supply, it can be stated absolutely that the water will or will not cause disease. The standards promulgated by the Treasury Department are no longer standards; they offer simply a procedure by which to measure certain factors in the water supply, and it is absolutely essential to use one's best judgment in certifying the water. It is not always possible to base estimates upon a particular sample collected for certification, but consideration must be given to past records and analyses and the past history of the particular supply being examined. The provision of the regulations which requires that certification should be made only once every six months is a weak one, inasmuch as it is entirely possible to collect samples of certain waters at certain periods or times which would show a satisfactory bacterial analysis that would make it possible to certify the water for use on railroads, and yet, at the same time, may be no indication whatever of the worst condition of that water supply which it is liable to pass through, possibly many times, before the six months' period has elapsed. Of course it is realized that this matter is not yet entirely upon a definite basis, and the speaker suggests these things, not for the purpose of criticism, but in order that an effort will be made to put the certification of water supplies for interstate traffic on a higher plane in the future by an accumulation of data from the different departments and persons who are engaged in this work.

J. N. CHESTER: If the men engaged in icing tanks use their rubber gloves for other things, one would not have so much confidence in them. The speaker saw, in one instance, a Pullman porter letting water run into one of the wash basins and dipping it from the washbasin up into the container.

LEONARD METCALF: The incident related by Mr. Chester recalls an experience without drinking cups after the rule was promulgated prohibiting the common drinking cup on trains. In going north from Denver, a short distance after leaving that city, a Mexican greaser was noticed coming forward in the car to the water tank to get a drink. Finding no cup there he twisted his head around, swallowed the spigot and satisfied his thirst. In rapid succession three other persons did the same thing. One could not help wondering how much improvement that was over the common drinking cup.